USGS Purple Loosestrife research and data collection

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U.S. Department of the Interior
U.S. Geological Survey

Thanks to Keith Edwards, Dasa Bastlova and Beth Middleton for sharing their data.

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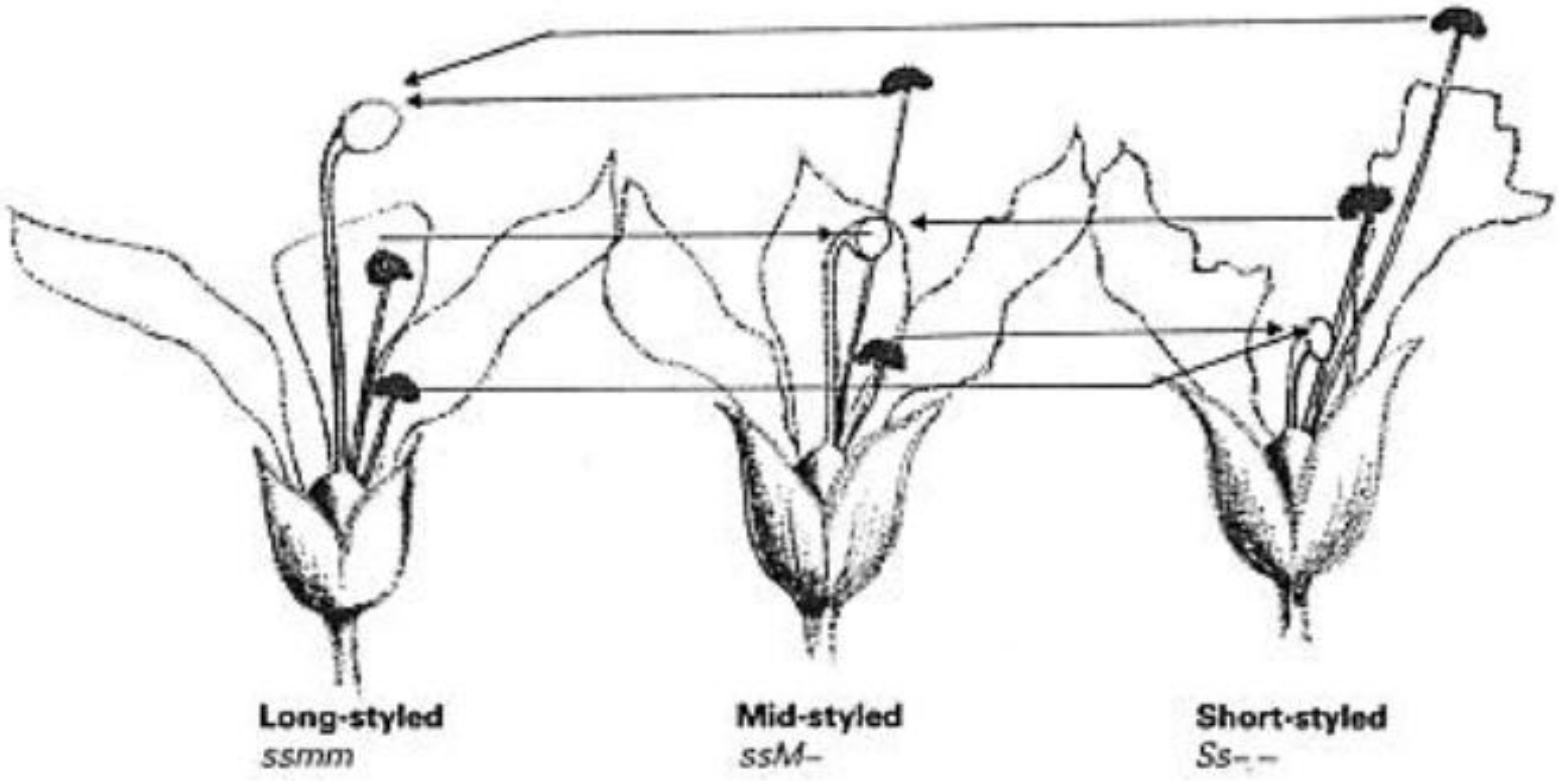
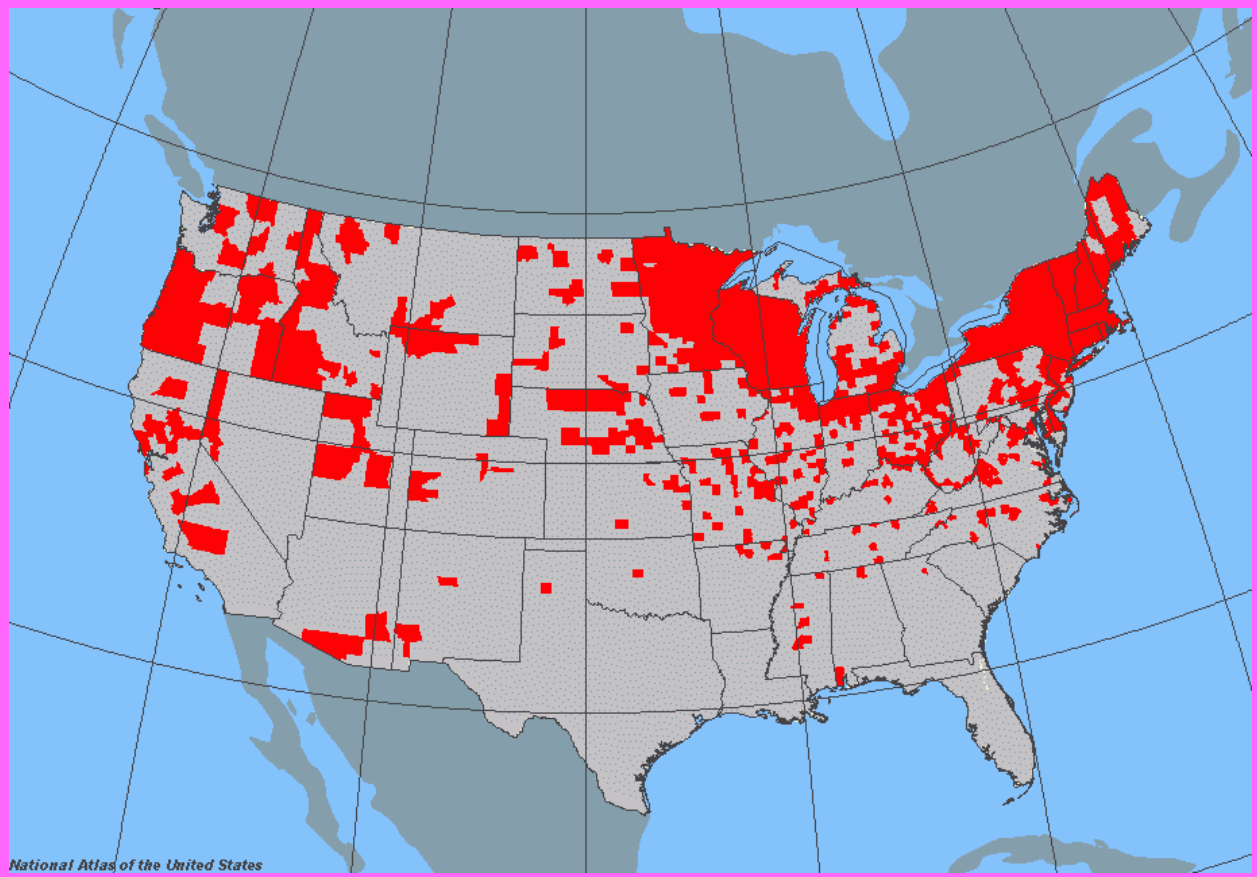


Figure 7.9 Tristyly in *Lythrum salicaria*. Stigmas are pale and anthers dark. Arrows indicate compatible pollinations between morphs.

Pollen: **yellow** **green** **green**

The Claim that Purple loosestrife has a negative effect on wildlife and alters wetland functioning has recently been disputed (Hager and McCoy 1998). Nevertheless we have seen situations where purple loosestrife dominates wetlands.

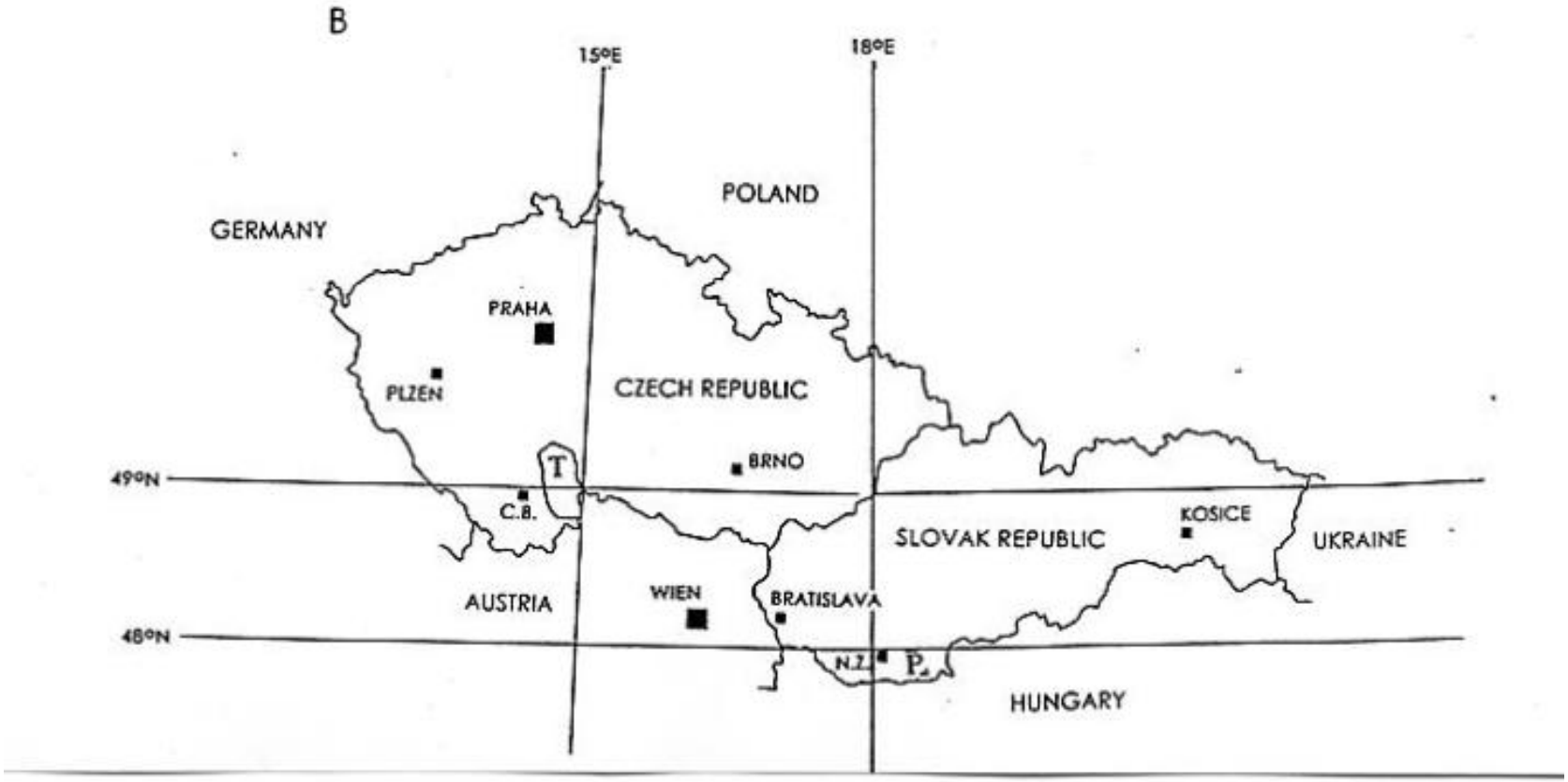
Mainland US Purple Loosestrife Distribution



- Recent research suggests that purple loosestrife may significantly draw pollinators away from native wetland species and reduce seed set in the native winged loosestrife (*Lythrum alatum*): Grabas and Laverty 1999, Grabas and Lavoie 1999, Brown et al 2002.

Why invasive?

- Herbivore release
- Hybrid vigor of strains
- Climate is optimum
- Out competes natives
- Habitat conditions


B
15°E
18°E
POLAND
GERMANY
PRAHA
PLZEN
CZECH REPUBLIC
BRNO
T
49°N
C.B.
SLOVAK REPUBLIC
KOSICE
UKRAINE
AUSTRIA
WIEN
BRATISLAVA
48°N
N.Z.
P.
HUNGARY

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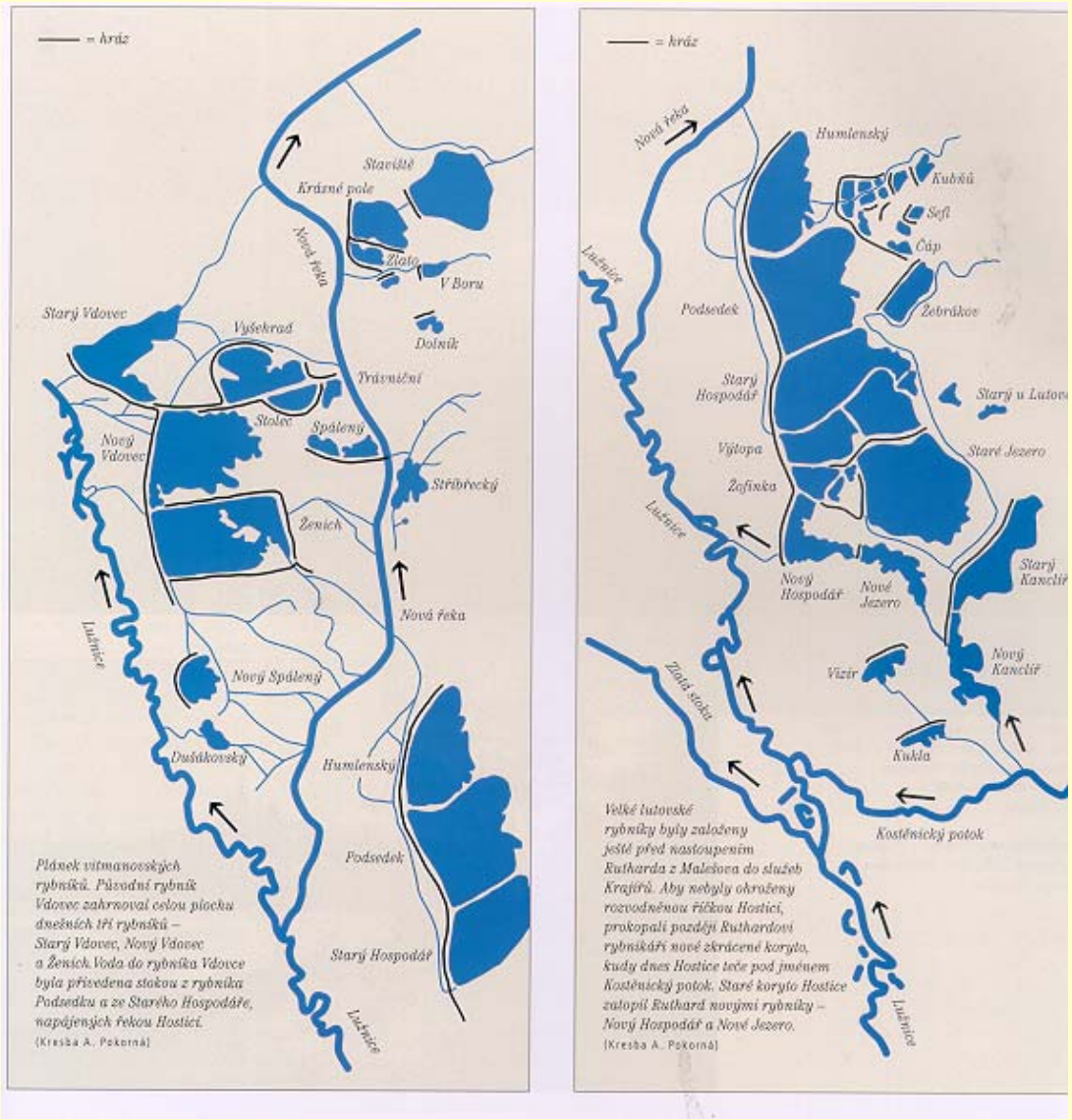
BROCK AND KEITH IN TŘEBOŇ

Abundant wetlands resulting from 14th Century River Diversion for



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Dr. Jan Kvet and Dasa Bastlova in purple loosestrife ditch

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ROADSIDE AND

WETLAND FRINGE HABITATS

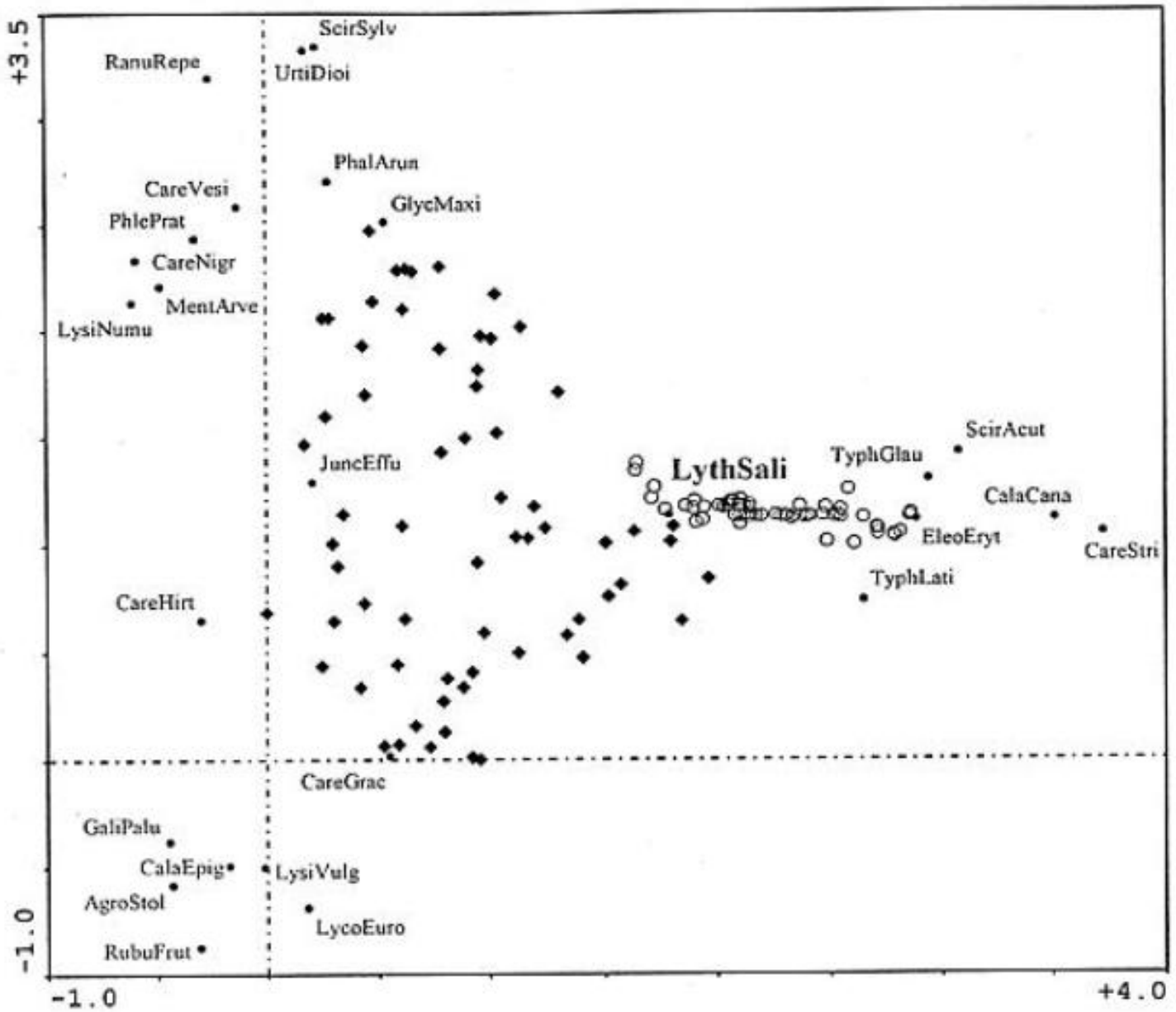

SEARCHING FOR DIMINUATIVE
PURPLE LOOSESTRIFE

Habitat in Turkey

CZECH AND INDIANA DUNES POPULATIONS

Table 2. The most frequent plant species associated with *Lythrum salicaria* in native and invasive ranges of occurrence. Percent frequency of occurrence was counted as number of phytosociological relevés in which the species was found/ total number of phytosociological relevés (N).

	Třeboň Basin Biosphere Reserve (CZ) (N=66)		**Indiana Dunes National Lakeshore (USA)** (N=62)	
Total number of plant species	129		40	
The most frequent species	*Calamagrostis epigejos*	21%	*Calamagrostis canescens*	37%
	Juncus effusus	21%	*Typha latifolia*	23%
	Ranunculus repens	21%	*Eleocharis erythropoda*	21%
	Glyceria maxima	20%	*Carex stricta*	18%
	Galium palustre	18%	*Scirpus acutus*	15%


+3.5
-1.0
-1.0
+4.0
ScirSylv
RanuRepe
UrtiDioi
PhalArun
CareVesi
GlycMaxi
PhlePrat
CareNigr
MentArve
LysiNumu
ScirAcut
TyphGlau
LythSali
JuncEffu
CalaCana
EleoEryt
CareStri
TyphLati
CareHirt
CareGrac
GaliPalu
CalsEpig
LysiVulg
AgroStol
LycoEuro
RubuFrut

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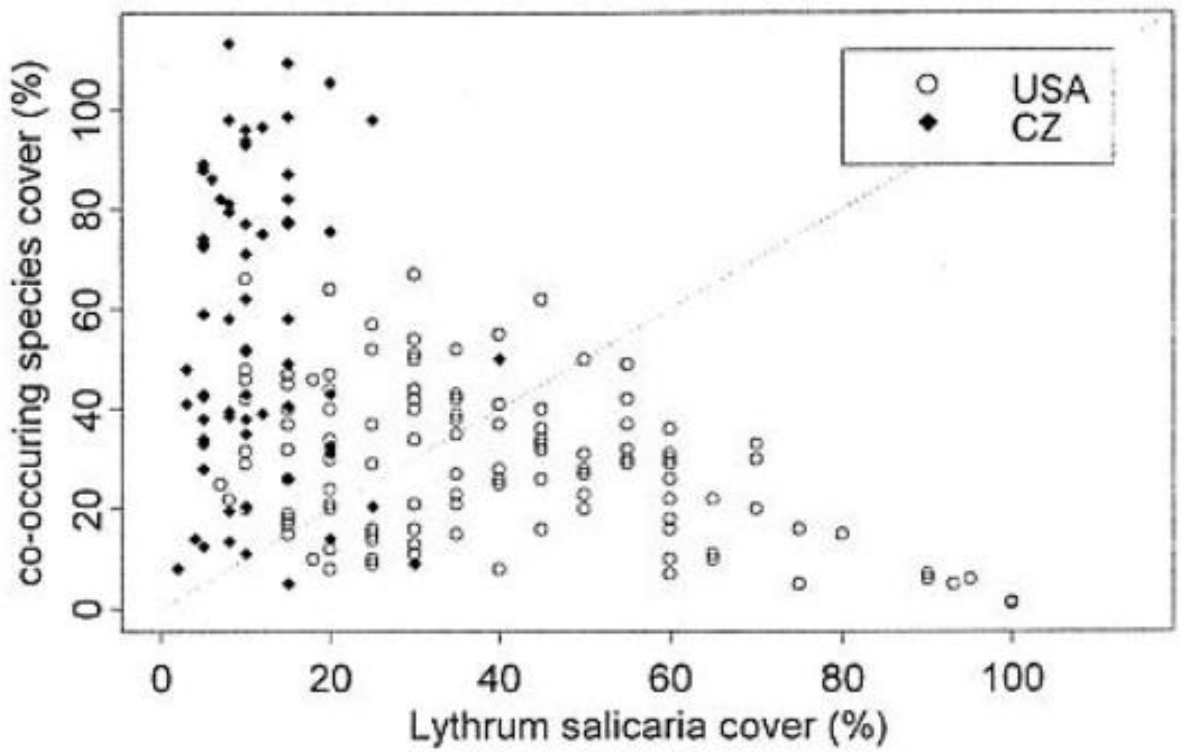

Fig. 3. Relationship between percent cover of *Lythrum salicaria* and total percent cover of associated species in native European and invasive American sites. Total percent cover of co-occurring species was calculated as sum of particular species covers. This resuled in few values greater than 100% due to overlapping in plant communities. Dotted line shows equal percent cover of L. salicaria and co-occurring species.

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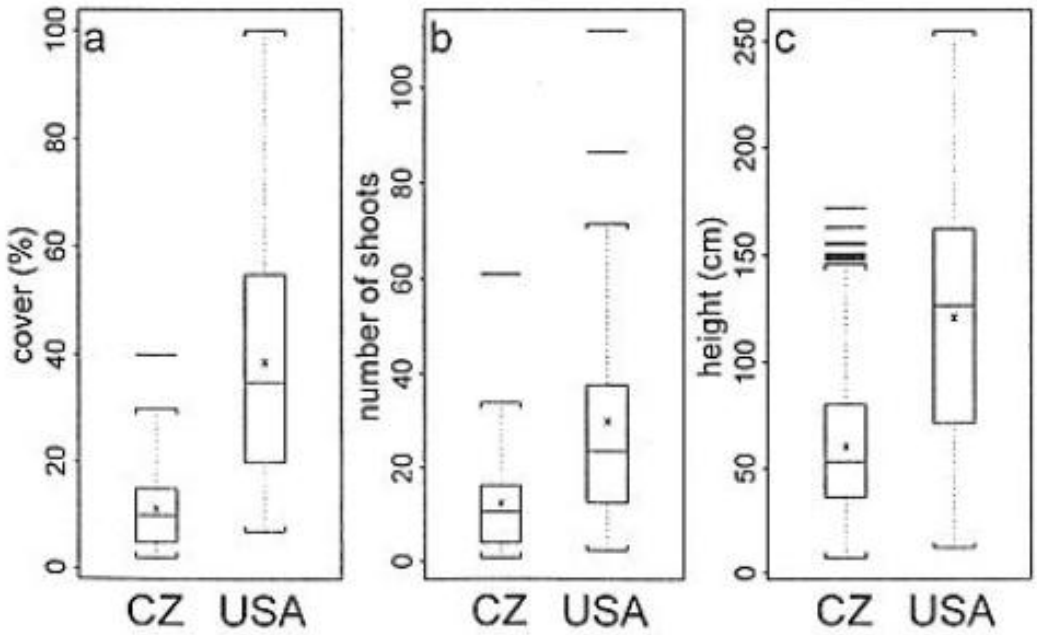

Fig. 4. Box and Whisker plots showing: a) percent cover, b) population density (number of shoots per $1m^2$) and c) plant height of *L. salicaria* in native (CZ) and invasive (USA) populations. Graphs show the upper and lower quartile (box size), mean values (x), median (black stripe inside the box), upper and lower extreme - nearest values not beyond a standard span (1.5x inter quartile range) from the quartiles (whiskers) and outliers (black lines beyond whiskers) (Hoaglin et al. 1983).

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PURPLE LOOSESTRIFE (*Lythrum salicaria*) Habitats

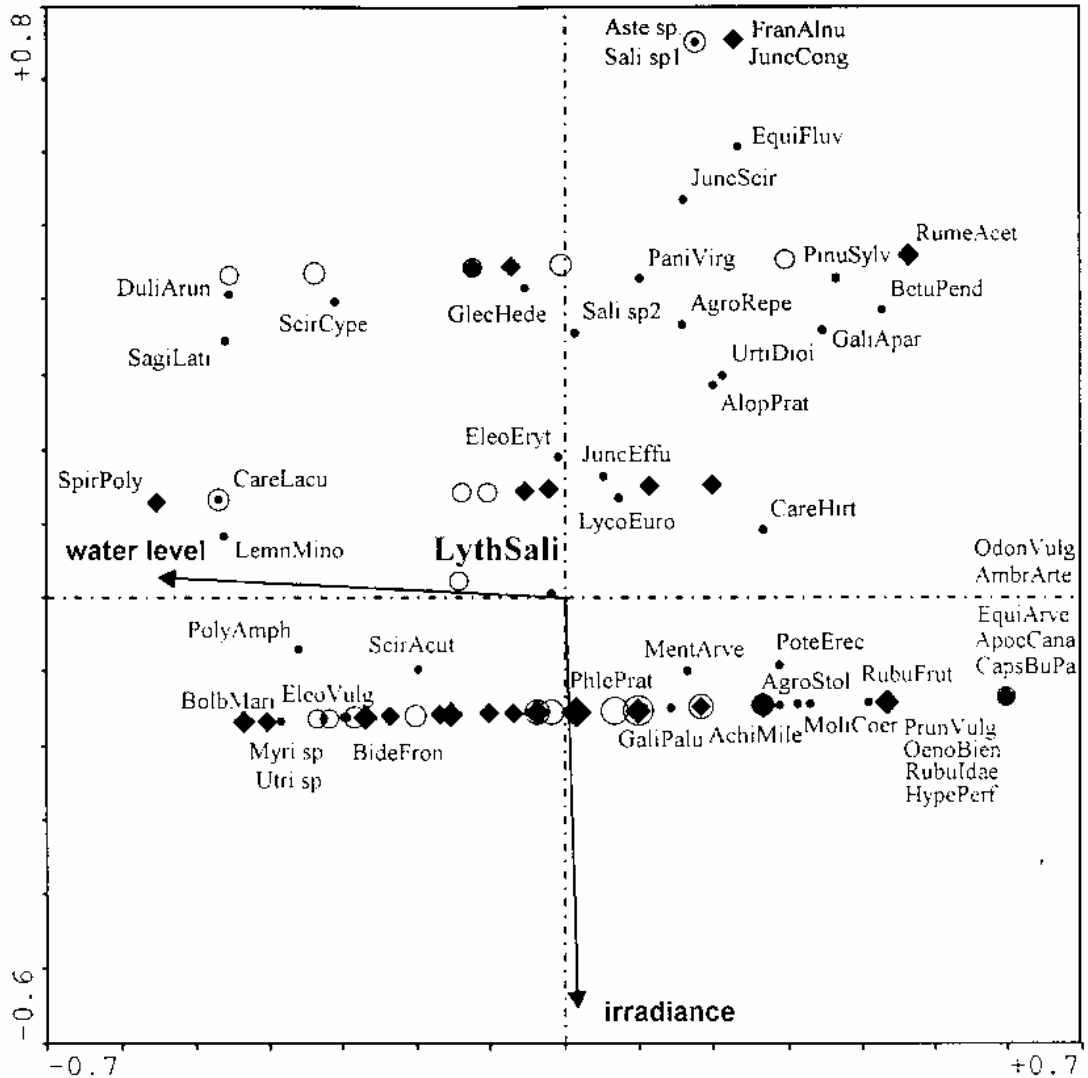


Fig. 2. Results of Cannonical Correspondence Analysis (CCA) ordination. Biplot shows the relationship of site (either invasive or native) and environmental variables (water level and irradiance). Percentage of variability in species data explained by the CCA axis is 2.2% for 1st axis and 1.8% for 2nd axis. (For differentiation of sites and plant species see legend in Figure 1. The size of site symbols reflects the number of relevés at the same point in the ordination diagram ranging from one (the smallest symbols) to six (the largest symbol)) (For abbreviations and full species names see Appendix 2)

CZECH AND US POPULATIONS DIFFER IN WATER DEPTH

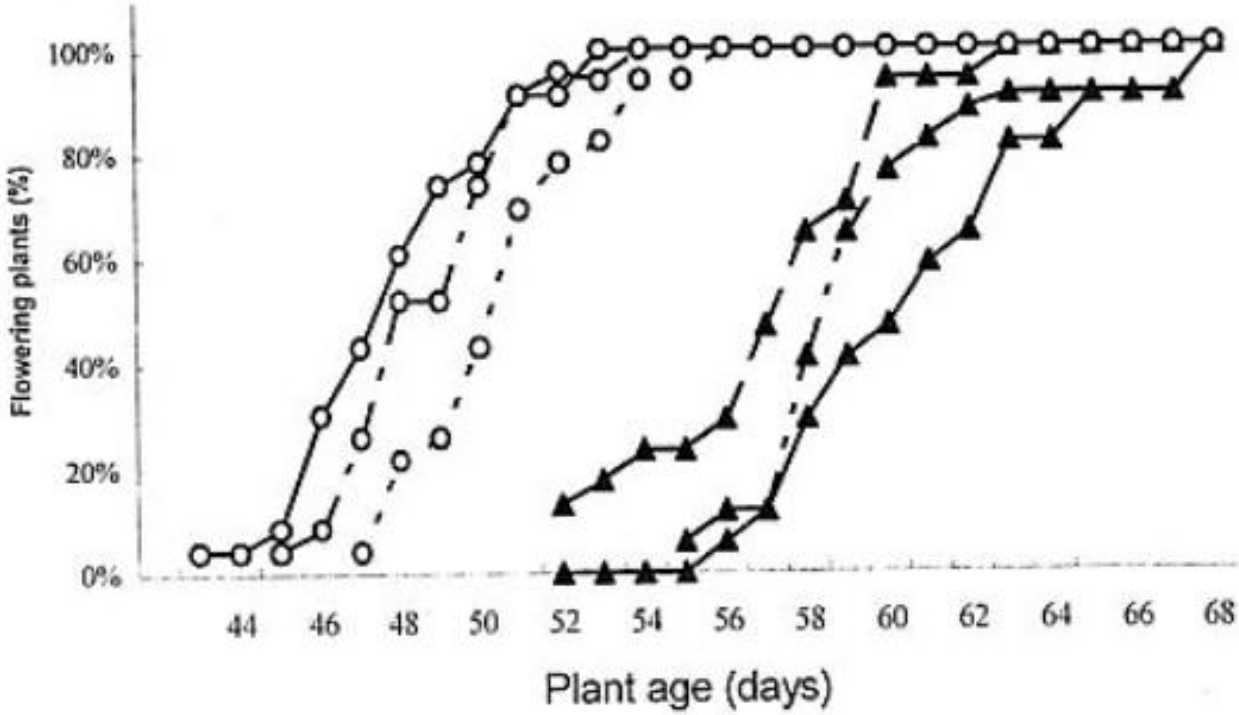


Figure 5. Flowering phenology of native and non-native plants. (For legend see Fig. 1)

In common garden study, non-native plants differed in height and biomass partitioning related to flowering phenology

Keith Edward's Research

- Demonstrated the importance of nutrient poor versus nutrient rich sites on the structure, density and dynamics of purple loosestrife.
- Inter-continental differences in growth are not due to climatic differences.

Purple Loosestrife is not always successful!

- Keith found that a small population in a wet meadow was eliminated when the site dried out and this decline was probably facilitated by the competition from blue joint grass (*Calamogrostis canadensis*)

Unacceptable Tradeoff?

- Purple loosestrife in West Long Lake is kept in check by the mass of cattail (*Typha* X *glauca*) litter except where disturbance has created gaps in the thick thatch.
- *Typha* X *glauca* is a serious wetland invader!

Dr. Beth Middleton
USGS National Wetlands Research Center, Lafayette, LA USA

Purple Loosestrife Volunteers

USGS

- **Whether or not it can be considered to be extremely detrimental to invaded wetlands, managers of wetlands need to have a better idea of whether or not purple loosestrife is likely to invade their regions (e.g., southern United States), and if there are any environmental constraints of its growth that can be used to control purple loosestrife in invaded wetlands. The purpose of this study is to better understand the physiological capability of purple loosestrife to grow in various latitudes in its native (Eurasia/Australia) versus invasive environments (North America), to help decision-makers make projections about the potential of the species to spread to unoccupied latitudes.**

USGS Purple Loosestrife Study, National Wetlands Research Center

Name of Volunteer: Email: Telephone: Survey date:

GPS Coordinates (if available): Region (e.g., county, parish, province): T__N, R__E/W

Number of individuals in Patch:

Soil characteristics (e.g., peat, sand, gravel):

Loosestrife Characteristics Survey Form

Plot #	Loosestrife Stem Number			Height of Loosestrife, centimeters			Tree Canopy Coverage			Water Depth, centimeters			Notes
	Quad 1	Quad 2	Quad 3	Quad 1	Quad 2	Quad 3	Quad 1	Quad 2	Quad 3	Quad 1	Quad 2	Quad 3	
SAMPLE x	10	1	25	100	150	90	F	F	S	0	1	10	Tall trees to east of site.
SAMPLE xx	13	XX	XX	86	XX	XX	F	XX	XX	7	XX	XX	Small clump in ditch.
1													
2													
3													

USGS Purple Loosestrife Study

formrevision January 26, 2004

1) Record your data on the "Loosestrife Characteristics Data Form." Use one sheet for every site. In other words, each place that you stop by the road should have a different data sheet.
2) Select a 1-m sampling area by tossing a rock or a stick from the edge of the infestation. A stick with a ribbon tied to it might be best if the vegetation is tall.
3) Mark a 1-m^2 area around the rock with a tape or meter stick. If there is purple loosestrife inside of the marked quadrat, then this area is your quadrat for sampling.
4) Count the number of loosestrife stems within the 1- m^2 quadrat. Record that number in the "Loosestrife Stem Number" column for the appropriate site number and quadrat number on the data sheet.
5) Measure the height of the tallest loosestrife plant within your quadrat. Record that height in centimeters in the "Loosestrife Height" column on the data sheet.
6) Look straight up from the quadrat and estimate how open the tree canopy is above the entire purple loosestrife site. Record "Tree Canopy Coverage" using the following symbols:
   a. If there are no trees present, record F for "full sun."
   b. If there are trees or some other shade-producing structure, such as a bluff or wall, on one or two sides of the site, such that the site receives full sunlight for part of the day, then record S for "some shade."
   c. If trees surround the site so that it receives only dappled sunlight, then record D for "dappled sun."
7) Record in centimeters the water depth in the quadrat, under the "Water Depth" column.
8) Repeat steps 2 through 7 for two additional quadrats in different parts of the patch.

Once the data are collected mail the forms to one of the following addresses.

Wisconsin Researchers:

Send completed forms to:
WWA, Purple Loosestrife Survey
222 S. Hamilton Street, Ste. 1
Madison, WI 53703

Researchers outside of Wisconsin (Australia, Canada, China, India, Europe, United States)

Send completed forms to:
USGS National Wetlands Research Center, Purple Loosestrife Survey
700 Cajundome Boulevard
Lafayette, LA 70506 USA

This document prepared by the National Wetlands Research Center

URL - http://www.nwrc.usgs.gov/special/purplel/forms.htm

SUMMARY

- Purple loosestrife has different physiological ability to grow invarious climates associated with specific latitudes.
- Purple loosestrife may not have the ability to invade all portions ofNorth America (e.g., southern United States).
- Follow-up studies of the growth of ecotypes of purple loosestrife under simulated climates are planned.
- Studies of latitudinal variation help decision-makers decide how to focus their efforts before invasion occurs.
- Volunteer efforts are particularly helpful in this fiscal climate of shrinking budgets!

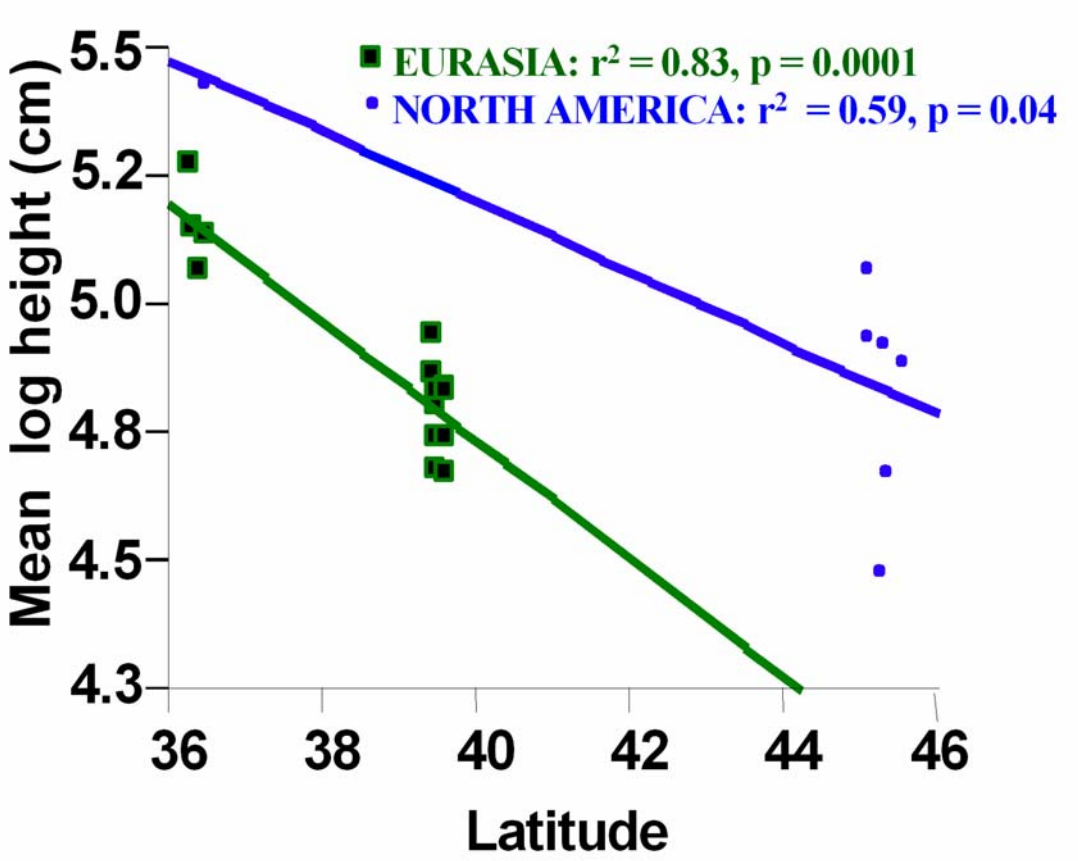
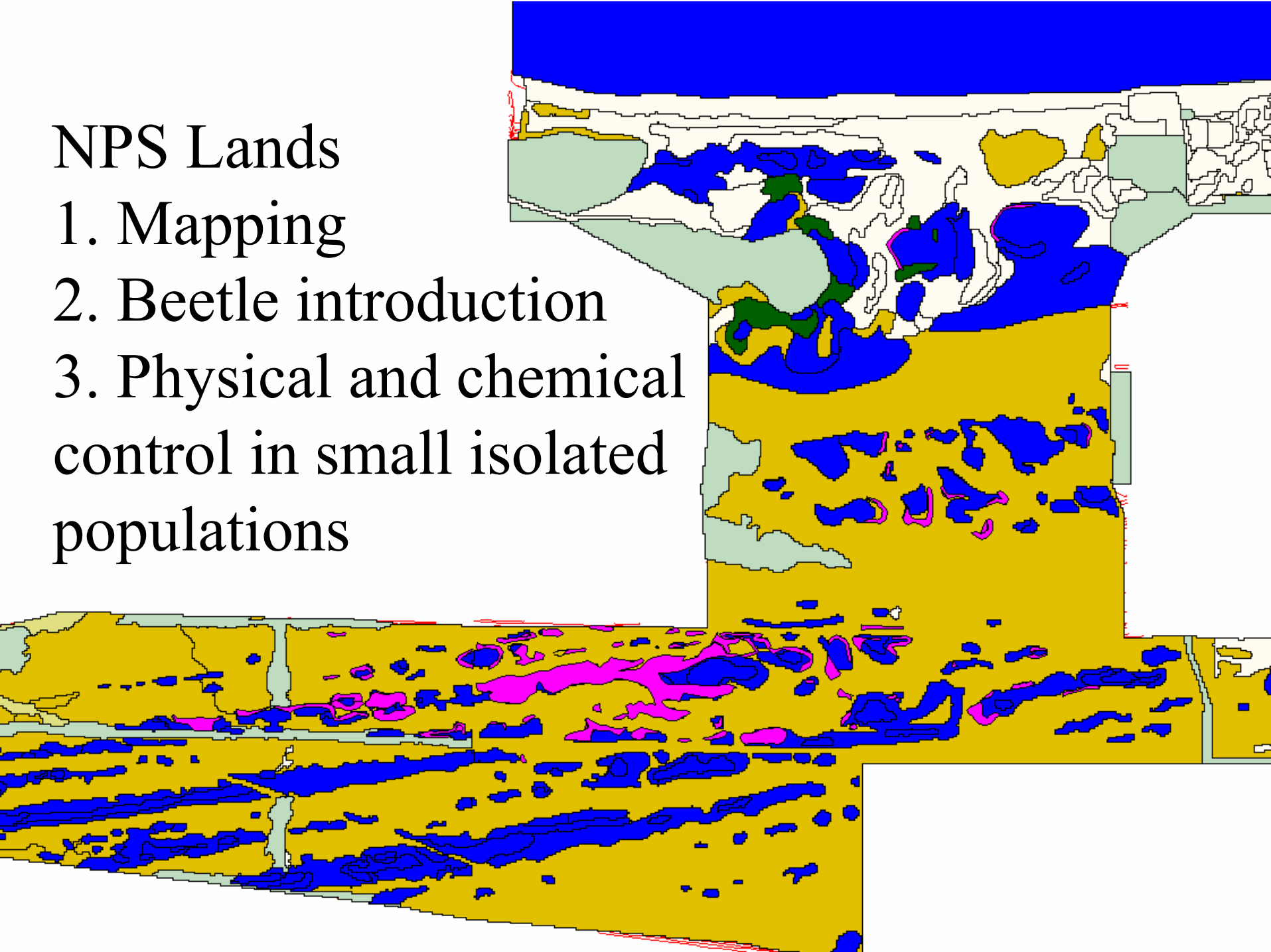


Fig. 1. Preliminary data of mean log height (cm) across latitudes in Eurasia vs. North America collected by volunteers and showing the current status of the building data set. We need volunteers at all latitudes, particularly the ones with data gaps.

NPS Lands

1. Mapping
2. Beetle introduction
3. Physical and chemical control in small isolated populations



Non-native plants of purple loosestrife differ in their growth and phenology compared to genotypes found in its native range. One of the major unanswered questions is what is the genetic nature of the differences between Eurasian and North American plants. USGS research programs hope to answer this question to help develop Better management tools.

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